

TRANSACTIONS  
OF  
THE LINNEAN SOCIETY.

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I. *Report on a Collection of Cephalopoda from the Calcutta Museum.* By EDWIN S. GOODRICH, B.A., F.L.S., Assistant to the Linacre Professor of Comp. Anatomy, Oxford.

(Plates 1-5.)

Read 19th December, 1895.

LAST year Professor E. Ray Lankester received for examination from the Calcutta Museum a large collection of Cephalopods, which he kindly handed over to me to be identified. The work was carried on at the Oxford Museum and at the British Museum, Cromwell Road, and I must express my thanks to Dr. A. Günther and Mr. E. A. Smith for placing the collections in the latter Institution at my disposal.

The present collection is composed almost entirely of specimens captured during the voyages of H.M.S. 'Investigator.' It contains 162 specimens, belonging to 28 genera.

Eleven new species are described, belonging to the genera *Iniotheuthis*, *Sepia*, *Loliolus*, *Sepioteuthis*, *Abralia*, *Cheirotheuthis*, *Histiopsis*, *Taonius*, and *Octopus*. No new genus has been founded; but four genera included are new to the Indian region. Of these the genus *Calliotheuthis* has been recorded from the Atlantic and Pacific regions; the genus *Histiopsis* from the Atlantic; and the genera *Loliolus* and *Iniotheuthis* from the Pacific and Japanese regions.

## DECAPODA MYOPSIDA.

## Family SEPIOLINI.

*INIOTEUTHIS MACULOSA*, n. sp. (Pl. 1. figs. 1, 2, & 3.)

One specimen from the Andamans, and another from the Persian Gulf; both females.

The principal measurements of the first are \* :—

Length of mantle (lower surface) . . . . .	1.3	centim.
Breadth „ . . . . .	.95	„
„ „ attachment to neck . . . . .	.4	„
„ between fins . . . . .	.8	„
„ across eyes . . . . .	.7	„
„ of fin . . . . .	.4	„
Length of fin-attachment . . . . .	.4	„
„ from extremity of mantle to tip of dorsal arm .	2.4	„
Length of dorsal arm . . . . .	.8	„
„ dorso-lateral arm . . . . .	.10	„
„ ventro-lateral „ . . . . .	.11	„
„ ventral „ . . . . .	.7	„
„ tentacular „ . . . . .	2.1	„
„ „ club . . . . .	.5	„

The mantle is rounded at its apex. The round fins are attached about halfway up the mantle. The band uniting the mantle to the neck is narrower than in *In. Morsei*. The funnel has a small opening, and a wide base on which are l-shaped sockets. The two muscular bands which unite the base of the funnel above the sockets to the head are less prominent than in *Sepiola* or *In. Morsei*. There are glandular pads and a small valve inside the funnel.

The edge of the buccal membrane is notched, but the lobes are not distinctly marked.

The first two pairs of arms are rounded; the ventro-lateral arms are slightly keeled; the ventral arms are provided with a well-developed keel on the upper edge. They all bear two rows of round suckers, obliquely set on slender stalks rising from a swollen base. The opening of the sucker is wide; the horny ring has an ornamented surface and a smooth edge.

The tentacular arms are flattened, and a groove runs down the inner surface. The club is of great length, slightly enlarged, provided with a lateral membrane on both sides, and a large number of minute suckers in eight rows. Each sucker is nearly hemispherical, set obliquely on a long slender stalk (fig. 3). The papillary area of the horny ring is wide, and the edge armed with about 15 teeth (fig. 2).

The ground-colour of the first individual is pale brownish yellow, inclining to orange

\* In the following descriptions the terms “upper” and “lower” are used to denote the surfaces generally called “dorsal” and “ventral;” since, strictly speaking, they do not correspond to the morphological dorsal and ventral surfaces.

on the arms and upper surface of the mantle. Scattered over the mantle, more especially on the lower surface, are large brown chromatophores (fig. 1); similar chromatophores are seen on the upper surface of the fins, and on the head and arms. There is a conspicuous row of five between the eyes on the upper surface of the head.

The second specimen is of a duller tint and less well preserved.

This species appears to be more closely related to *Inioteuthis japonica* (Tilesius, MS.), Verrill, which also has two rows of suckers on the arms, than to *In. Morsei*, Verrill, which has four.

*INIOTEUTHIS MORSEI*, Verrill.

Seven specimens from the Andamans have been placed in this species.

Family SEPIARII, Stp.

Subfamily SEPIADARII, Stp.

*SEPIADARIUM KOCHII*, Stp.

Four specimens, all female. One from off the south coast of Ceylon, lat. 6° 6' 30" N., long. 81° 23' E., from a depth of 32 fathoms. The other three from the Andamans.

*SEPIA SINGAPORENSIS*, Pfeffer.

One female specimen from Singapore.

*SEPIA ACULEATA*, von Hasselt.

Ten specimens appear to belong to this species. One from the Irawaddy delta, at a depth of 20 fathoms; four from Port Blair, and five from the Andaman Sea.

*SEPIA SINGALENSIS*, n. sp. (Pl. 1. figs. 4, 5, 6, 7, & 8.)

Two male specimens; the first from Colombo, the second from off Point Galle (?).

The principal measurements of the former are:—

Length of mantle (above) . . . . .	16	centim.
"    "    (below) . . . . .	14.4	"
"    from "    apex to mouth . . . . .	17.4	"
Breadth of "    at origin of fins . . . . .	4.9	"
"    "    halfway . . . . .	6.2	"
"    fin . . . . .	1.2	"
Length of dorsal arm . . . . .	7	"
"    dorso-lateral arm . . . . .	6.5	"
"    ventro-lateral " . . . . .	6.3	"
"    ventral " . . . . .	6.7	"
"    tentacular " . . . . .	12.7	"
"    "    club . . . . .	3.1	"
"    pen . . . . .	15.5	"
Breadth of " . . . . .	4.8	"

The mantle is of a narrow oval shape; the strong fins arise a little way below the mantle-margin, and do not join at the apex (fig. 4). The siphon is thick-walled, with a somewhat crescentic opening; it does not reach to the junction of the ventral arms.

The arms have broad compressed bases (especially the ventral arms, which are 23 mm. broad), without well-developed keels. The inner surfaces, bounded on either side by narrow lateral membranes, bear four rows of moderate-sized suckers, largest on the lateral arms, where they attain a diameter of 2 mm. On the distal half of the arms the suckers become extremely small. The horny ring of the arm-suckers has a narrow papillary area, and a margin smooth on the proximal two-thirds of its circumference, and armed with very irregular teeth on the distal third (fig. 8).

The stem of the tentacle is compressed, forming a sharp edge on the outer surface. The club is furnished as usual with a wide keel springing from the upper surface. Suckers of very unequal size are placed in four rows on the proximal region; the largest attain a width of 4 mm. in the two central rows, and are provided with smooth horny rings. The suckers diminish rapidly in size at either end; these and the suckers of the outer rows have horny rings armed all round with numerous sharp teeth (fig. 7). In the distal region the small suckers are closely packed in six or seven rows, and near the extreme apex two suckers stand out from the rest on the upper margin as if utilized for some special purpose (an arrangement I have noticed in *Sepia officinalis*).

The buccal membrane has seven lobes provided with a few suckers, the horny rings of which closely resemble those of the arm-suckers.

A small web is developed at the bases of the arms except of the ventral pair.

The mandibles are shown in fig. 6.

The long oval pen of this *Sepia* is very remarkable (fig. 4). Above, the rough calcareous surface raised in three slight ridges narrows anteriorly, and is bounded on either side by a broad expanse of the chitinous margin (*ch.m.*) (in places about 1 cm. broad). Below, the striated area formed by the loculi reaches far up (*loc.*), and is marked in the centre by a longitudinal groove. The margin of the inner cone is produced forwards and reflected over the posterior loculi, to which it is closely applied (*i.c.*).

The apical spine has unfortunately been broken off; it appears to have been small.

It is not without hesitation that I have placed these specimens in a new species, as they closely resemble *Sepia Rouxii*, d'Orb., described in d'Orbigny and Férussac's monograph from the Indian seas (5).

There are, however, several characters in which the two species differ. Whereas *S. Rouxii* is of a "forme générale racourcie," has very wide fins, and toothed rings to all the suckers of the tentacular club, *S. singalensis* is of narrow shape, with moderate fins, and smooth rings on the largest suckers. On the other hand, their pens are remarkably similar.

The ground-colour of the best specimen is pale brown, speckled with slate-coloured chromatophores on the lower surface, and conspicuously striped with broad dark bands on the upper surface of the mantle, head, and arms.

The hectocotylized region is short and situated about halfway up the left ventral arm.

At this point the suckers are small and resting on elevated transverse ridges. Scattered about the siphon of one specimen are spermatophores, conspicuous for the covering of black adhesive substance at the base (fig. 5).

SEPIELLA INERMIS (van Hasselt, MS.).

Among the 25 specimens referred to this species there is great variation as to general appearance, shape, width of the fins, and details of the structure of the pen. Nevertheless I have not been able to distinguish any modifications of specific importance. The differences in the soft parts seem to be due to varied preservation. Six specimens were captured near Madras, three near Bombay, five at Sandheads, one in the Chilka Bight, one at Mergui, two at Singapore, two at Penang, and five off the Ganjam coast at a depth of 10 fathoms.

Family LOLIGINEI.

SEPIOTEUTHIS INDICA, n. sp. (Pl. 1. figs. 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, & 19.)

Although the nine specimens in the collection belonging to the genus *Sepioteuthis* differ considerably in size and colour, I refer them all to one species. The best-preserved individuals are of a pale brownish-yellow ground-colour, sprinkled with slate-coloured chromatophores, very thickly on the upper surface of the mantle, head, and arms, more sparsely on the lower surface.

Seven specimens come from the Andamans, and two from Singapore.

Below are the principal measurements of a large male and of a large female:—

	Large Male. centim.	Large Female. centim.
Length of mantle (lower surface) . . . . .	15.5	18.3
Breadth „ near margin . . . . .	5.1	5.9
„ „ halfway . . . . .	5.1	6.1
„ fin 7 cm. from mantle-edge . . . . .	2.9	2.9
„ „ 10 cm. from mantle-edge . . . . .	3	12.5 cm. from } 3.6 mantle-edge }
Length of dorsal arm . . . . .	5.2	5.5
„ dorso-lateral arm . . . . .	6.3	6.5
„ ventro-lateral „ . . . . .	8	9
„ ventral „ . . . . .	7.4	8.6
„ tentacular „ . . . . .	13.5	15
„ „ club . . . . .	5.2	6.7
Length of pen . . . . ♂ 13 em.	♂ 20.5 cm.	12.7 cm.
Breadth of pen . . . . .	4	3

From the outline figure given (fig. 9) it will be seen that the fins are perfectly rounded, while the mantle from about halfway tapers to a blunt point; the whole forming an almost perfect oval. In this respect this species resembles *S. Blainvilliana*, Fér., and *S. mauritiana*, Q. & G. The fins begin .35 em. from the margin of the mantle and join

behind at the apex. The siphon presents no peculiarity. The olfactory fold below the eye is prominent, undulating, and with its two extremities turned forwards (fig. 13).

The buccal membrane is large (in one specimen extending 2 cm. beyond the mandibles), and provided with seven lobes bearing suckers. The horny ring of the latter is armed on its distal border with strong teeth (fig. 15). The jaws are shown in fig. 14. Adhering to the buccal membrane of this specimen (a large female) are spermatophores very similar to those of *Loligo indica* (Pl. 2. fig. 28), but slightly thicker.

The powerful arms are provided on both edges of the inner surface with a lateral membrane, strengthened by transverse muscular ridges springing from the base of the suckers. This membrane is especially well-developed on the lower edge of the second or dorso-lateral arm. A median outer keel is developed along the dorsal and ventro-lateral arms; a lateral keel on the outer lower edge of the dorso-lateral arm; and two lateral keels on the ventral arms, the upper one being large and membranous.

The suckers, closely set in two rows, are of moderate size, largest on the dorso-lateral arms, where they attain a diameter of .35 cm. The horny ring is armed with from 20 to 28 strong teeth (generally 21–22), rather larger on the distal border (fig. 17).

The stem of the tentacular arm is thick, and flattened near the base (13 mm. broad about 5 cm. from the base in the large female already mentioned), from the inner edge of which springs a membrane reaching down below the buccal membrane. The club is wide, provided with a keel on its outer edge and with a membrane on either side, and bears four rows of suckers of unequal size. The largest suckers, situated towards the centre of the club, reach a diameter of 5 mm.; their horny rings are armed usually with 15 teeth (figs. 18, 19) (sometimes with 16–18 teeth). The smaller distal and proximal suckers and the outer rows of suckers usually have 17 large sharp teeth on the distal border. At the tip of the club is a slightly spoon-shaped expansion, on which the suckers are modified, and arranged in two rows on either side enclosing a space (fig. 12). These suckers are highly specialized, being small, flat, and very short-stalked; the papillary area of the horny ring is very wide and beset with rows of conical teeth reaching the margin (figs. 11 & 12). Such a special group of suckers constitute what I shall call the apical set, an arrangement which has not, so far as I am aware, been noticed by previous observers in the Myopsida. It is found in both sexes, and reminds us strongly of a somewhat similar group in *Onychoteuthis*; the apical set of suckers, perhaps, forms a sort of "connective apparatus." It occurs also in *Loligo Pealei* and *L. indica*; on the other hand, it appears to be absent in *L. marmora* and in the genus *Loliolus*.

In the male the hectocotylized left ventral arm is modified from about the 23rd pair of suckers to the tip. In this region (fig. 16) the suckers are reduced to conical papillæ. The right arm, as noticed in other species by Steenstrup (7), is also slightly modified, the suckers near the tip being unusually small.

The pen is very like that of *Sepioteuthis Blainvilliana*, Fér., thin, lanceolate, convex above, with a strong, raised, convex ridge down the middle (fig. 10).

It is often very difficult to distinguish between the various species of this genus described by authors. *Sepioteuthis Blainvilliana*, Fér., and *S. mauritiana*, Q. & G. (5),

seem to be the nearest allies of this new species. From the former it is distinguished by the lesser number of teeth on the horny rings of the arm and tentacular suckers, by the presence of suckers on the buccal membrane, and by the undulation of the olfactory crest (?). From the latter, *S. mauritiana*, it is distinguished by the lesser number of teeth on the horny ring of the suckers and by the shape of the pen.

LOLIGO INDICA, Pfeffer. (Pl. 2. figs. 20, 21, 22, 23, 24, 25, 26, 27, & 28.)

To this species are referred eight specimens from Mergui, one from Camorta Harbour, one from Daley Sandheads (1887), and two from the mouth of the Mutlah River; also, with some hesitation, a large female from the Chilka Bight.

The first 12 specimens differ little in size; below are the measurements of a male and of the large female mentioned above:—

	♂.	♀.
	centim.	centim.
Length of mantle (upper surface) . . . . .	9·1	14
Breadth „ at beginning of fins . . . . .	1·9	3
Length of fin-attachment . . . . .	5	7·6
Breadth of fins combined . . . . .	4·3	7·65

Length of pen of a smaller ♂, 6·6 centim., breadth 1·2 centim.

„ „ the large ♀, 14 centim., breadth 2·7 centim.

I feel obliged to go into some detail concerning this species, since the figures and descriptions published by Mr. Hoyle of the ‘Challenger’ specimens (1) differ widely from Dr. Pfeffer’s original description (6).

Concerning the horny ring of the suckers of the arms, Pfeffer says, “Armringe mit 6 ziemlich grad viereckigen Zähnen; darauf folgt die erhabene Leiste, die vorn noch jederseits eine Einkerbung als Rudiment eines Zahnes zeigt.” This hardly agrees with Hoyle’s figures, but corresponds exactly to my figure of the horny ring of the female (fig. 26).

With regard to the horny ring of the suckers of the arms, I find that there is a well-marked sexual difference, for in the males these rings are armed with from 9 to 11 rounded teeth (fig. 20).

Again, concerning the horny ring of the tentacular suckers, Pfeffer says, “Grosse Tentakelringe mit etwa 21 spitz dreieckigen Zähnen, deren Basis schmaler ist, als die Zwischenräume.” While this description differs much from Hoyle’s figures, it agrees entirely with what I find (fig. 27). Although 21 is the usual number of teeth in these specimens, there are sometimes as few as 15 in the large female. Fig. 24 shows the horny ring armed with 6 strong teeth from one of the very small distal suckers of the club; while fig. 25 represents a portion of the horny ring from one of the suckers of the apical set at the tip of the club (cfr. *Sepioteuthis*, p. 6).

The lobes of the buccal membrane are provided with small toothed suckers, the horny ring of which is shown in fig. 21. I figure also a club-shaped spermatophore removed from the buccal membrane (fig. 28).

The hectocotyized arm of the male is strongly modified. On its proximal half are two rows of small suckers (fig. 22); on the outside of these the upper edge of the arm is drawn out into a wide thick flap (fig. 22, *fl.*). On the distal half of the arm the suckers are reduced to rounded projections (*m.s.* fig. 23) which bend over a groove. The outer and upper edge of the arm is developed into a lateral membrane of considerable width (*l.m.* fig. 23).

*LOLIOLUS INVESTIGATORIS*, n. sp. (Pl. 2. figs. 29, 30, 31, 32, 33, 34, 35, 36, & 37.)

Nine specimens, some of which are much mutilated. The specimen figured and one other come from the Mutlah River, five from the Yé River, one from Mergui, and one from Sangor. They vary considerably in size; the following are the principal measurements taken on the specimen figured, a male of average size:—

Length of mantle (upper surface) . . . . .	3·5 centim.
„ from apex of mantle to base of arms . . . . .	4 „
Breadth of mantle near edge . . . . .	1·3 „
„ across eyes . . . . .	1·35 „
„ „ combined fins . . . . .	2·9 „
Length of attachment of fins . . . . .	2·1 „
„ dorsal arm . . . . .	·8 „
„ dorso-lateral arm . . . . .	1·6 „
„ ventro-lateral „ . . . . .	2·1 „
„ ventral „ . . . . .	1·8 „
„ tentacular „ . . . . .	3·3 „

The mantle is of conical shape, with a rounded apex; its margin projects on the upper surface into a small point above the neck, and below on either side of the funnel (figs. 29 & 30). The fins have rounded anterior and lateral edges; the two together form a heart-like figure. They join and are continued beyond the mantle apex.

The head is large and provided with a transverse olfactory crest below the eye. The siphon possesses a valve, and muscular bridles hidden below the skin.

The three dorsal pairs of arms bear on their outer surface a median keel, especially well-developed on the 3rd pair. The ventral arms are somewhat square in section, and both the outer edges are drawn out into lateral keels. Small lateral membranes spring from the inner surface on the upperside of the 1st and 2nd pairs of arms, and on both sides of the 3rd and 4th pairs of arms. The suckers, in two rows, are obliquely set on their stalks (fig. 36); the horny ring is provided with three large blunt teeth (fig. 37).

The tentacular arms enlarge distally into small clubs, bearing an outer keel and four rows of suckers. The horny ring of these is armed with sharp teeth on its distal border (fig. 35).

A few small suckers are situated on the seven lobes of the buccal membrane; their horny ring strongly resembles that of the tentacular suckers, but there are only from four to six large teeth.

The mandibles are rather weak (fig. 34). The lower mandible has a sharp, hard, tooth-like point and a small basal tooth (*b.t.* fig. 34*b*).



The pen is lanceolate; narrow anteriorly, it broadens out to a thin blade behind (fig. 31).

In the male the left ventral hectocotylized arm is somewhat sickle-shaped (figs. 29 & 32). The upper outer edge is developed into a wide lateral membrane (*l.m.* fig. 33), and the suckers are more modified than in Steenstrup's species (7), the upper row being reduced to mere papillæ, and the lower row having almost entirely disappeared (fig. 33).

**OIGOPSIDA.**

Family ONYCHII.

*ABRALIA ANDAMANICA*, n. sp. (Pl. 2. figs. 38, 39, 40, 41, 42, 43, 44, & 45.)

Three specimens, captured at a depth of from 188 to 320 fathoms in the Andaman Sea, belong to this species. The following are the measurements of the largest specimen, a female (fig. 38):—

Length of the mantle (lower surface) . . . . .	3·8 centim.
„ from mantle-edge to base of arms . . . . .	1·2 „
„ of attachment of fins . . . . .	2·3 „
„ from mantle-apex to angle of fin . . . . .	2·7 „
Breadth of combined fins . . . . .	3·4 „
Length of dorsal arm . . . . .	1·7 „
„ dorso-lateral arm . . . . .	2 „
„ ventro-lateral „ . . . . .	1·8 „
„ ventral „ . . . . .	2 „
„ tentacular „ . . . . .	4 „
„ „ club . . . . .	·8 „

Length of pen of a male, 2·4 centim., breadth 35 centim.

The mantle is nearly conical, tapering gradually to the apex. At the free edge there is no pronounced dorsal point, but there is a small projection on each side of the funnel (figs. 38 & 39). The fins, rhomboidal in shape, reach about halfway up the mantle; their posterior edge is slightly concave, their anterior convex and more rounded.

The head is large, and fits closely on to the edge of the mantle. At the edge of the eyelid is a rudimentary sinus. On each side of the neck are two olfactory crests, the smallest being nearest the siphon. There is a well-developed valve in the funnel; and the socket at the base of the latter is I-shaped. The buccal membrane has 8 lobes; its inner surface is covered with papillæ of considerable size.

The first and second pairs of arms have a median external keel, and a small lateral membrane on the upper edge. The third, or ventro-lateral, pair has a large membranous keel (*k*, fig. 38), and a membrane along the lower edge. The ventral arms have the outer and upper edge drawn out into a lateral keel.

All these arms bear two rows of hooks for about three fourths of their length, and two rows of suckers on the distal quarter. On the ventral arm, for instance, 14 hooks and

12 suckers can be counted. These suckers are very obliquely set on short stalks (figs. 42 & 43), and of a compressed conical shape. The horny ring is studded with teeth, and the margin is armed with small teeth on the proximal side and large blunt teeth on the distal side.

The tentacular arms are scarcely at all enlarged to form the clubs (figs. 38 & 40). Each club bears a small keel externally, three hooks along the lower edge of the internal surface (*h*), and above these two rows of suckers. Beyond the hooks on the distal region small suckers are arranged in four rows. The horny ring of the suckers is furnished with small teeth round its margin (figs. 44, 45). Near the base of the club a set of three small short-stalked suckers alternating with three tubercles forms a connective apparatus (*c. app.* fig. 40).

Fig. 41 (*a* & *b*) shows the pen of a small male, the mantle of which is 3 cm. long; it is lanceolate, with a strong median ridge. This specimen has a large bundle of spermatophores in the mantle-cavity.

In colour the female is of pale yellowish-brown tinge, inclining to orange on the upper surface, covered with dark purple-brown chromatophores, most numerous on the upper surface of the mantle, head, and arms, and on the buccal membrane. The male is paler, the chromatophores being less numerous.

Both sexes are provided with a very large number of small dark tubercles, generally showing a white opaque lens in the centre, distributed over the lower surface of the mantle, head, funnel, and ventral arms (fig. 38).

These tubercles, no doubt luminous or phosphorescent organs, are evenly scattered over the lower surface of the mantle; on the siphon they are situated in six irregular longitudinal series; on the head there is a row round the lower half of each eye and nine rows between these. Three rows extend on to the base of the ventral arms, but only two are continued to their extremities.

*ABRALIA LINEATA*, n. sp. (Pl. 3. figs. 46, 47, 48, 49, & 50.)

Two specimens; one, a male, taken at a depth of 265 fathoms in the Andaman Sea, the other, a female, at a depth of from 90 to 100 fathoms off the Ganjam coast.

The principal measurements of the first specimen, which is the one figured, are given below:—

Length of the mantle (upper surface) . . . . .	1·5 centim.
„ „ (lower surface). . . . .	1·3 „
„ from mantle-apex to base of arms . . . . .	2 „
„ of attachment of fin . . . . .	·8 „
„ of posterior border of fin . . . . .	·9 „
Breadth of mantle . . . . .	·6 „
„ combined fins . . . . .	1·5 „
Length of dorsal arm . . . . .	·7 „
„ dorso-lateral arm . . . . .	1·0 „
„ ventro-lateral „ . . . . .	·9 „
„ ventral „ . . . . .	1·1 „
„ tentacular „ . . . . .	1·6 „

The short mantle tapers to a sharp point. The fins are rhomboidal, with anterior rounded border and nearly straight posterior border; they extend forwards more than halfway up the mantle beyond the point of attachment. The head, of about the same width as the mantle, is provided with large eyes, and fits less closely on to the mantle than in the preceding species (this may be due to differences in preservation). A small olfactory crest is situated behind the eye. The funnel has a valve, two well-marked bridles, and l-shaped sockets.

The buccal membrane has 8 lobes.

The three dorsal pairs of arms are rounded proximally and slightly keeled distally. The ventral arms have a lateral membrane on the upper side. Two rows of hooks are borne by all the arms along almost their entire length. The ventral arms appear to bear no suckers at all distally, but their tips are swollen, and provided in both sexes with three large convex pigmented organs forming a sort of club. These swellings are probably phosphorescent organs; they correspond exactly to the modified arms described by Pfeffer in *Enoploteuthis Hoylei*, Pfeffer, and considered by him to be due to hectocotyli-zation. The other arms bear, near their extremity, a small number of minute suckers, the horny ring of which is armed on the distal margin with large teeth (fig. 49).

The tentacular arm is slightly expanded to form a club, bearing in the middle region four hooks on the lower side, and three hooks alternating with suckers on the upper side (fig. 48). Beyond these are four rows of small suckers, with a wide ornamented papillary area and a smooth margin (fig. 50). At the base of the club is situated the connective apparatus of four suckers and tubercles (*c. app.* fig. 48).

The pen of the second specimen has been lost; the type-specimen figured I have not dissected.

The most striking characteristic of this pretty little Cephalopod consists in the distribution of the phosphorescent organs in regular rows on the lower surface of the mantle, funnel, head, and two ventral pairs of arms. The whole animal is of a creamy-white colour, with a few brownish chromatophores at rare intervals, more especially on the upper surface; two of these, of exceptional size, are situated on the upper surface of the head between the eyes (fig. 46). The eyes and buccal membrane are of a deep purplish-brown colour. The phosphorescent organs already mentioned are arranged in six longitudinal rows on the mantle, of which the two central rows are the widest; also on the funnel in six irregular rows (fig. 47). A row surrounds the lower half of each eye, and three rows extend between these. The median row bifurcates and runs up the two ventral arms, together with the lateral rows. The ventro-lateral arms are provided with one row of these organs, and a few are scattered along the edge of the mantle and over the neck. The ventral arms are abnormally long and slender, and it seems probable that the special organs already described at their tips are phosphorescent and used as search-lights.

#### ONYCHOTEUTHIS BANKSII, Leach.

I refer provisionally one male specimen from Sandheads, and one large female captured at a depth of 272 fathoms in the Bay of Bengal, to this species.

The latter only has an apical set of suckers to the tentacular club.

This genus is greatly in want of revision by some naturalist who could have access to the type-specimens.

### Family TAONOTEUTHI.

#### Subfamily CHEIROTEUTHIDÆ.

CHEIROTEUTHIS MACROSOMA, n. sp. (Pl. 3. figs. 51, 52, 53, 54, 55, 56, & 57.)

A single female specimen of this elegant Cephalopod was captured off the Kistna delta, lat. 12° 50' N., long. 81° 30' E., at a depth of 475 fathoms.

From figure 51 and the measurements given below, it will be seen that this new species of *Cheiroteuthis* is remarkable for the great length and graceful tapering of the mantle.

Length of body and arms (without tentacles) . . . . .	69 centim.
„ mantle (lower surface) . . . . .	36 „
„ „ (upper surface) . . . . .	38·5 „
Breadth of „ . . . . .	6 „
Circumference of mantle . . . . .	18 „
Length of attachment of fins . . . . .	14·8 „
Breadth of combined fins . . . . .	13 „
Length of mantle-apex beyond fins . . . . .	6 „
Breadth of „ „ „ . . . . .	2·5 „
Length from base of arms to posterior edge of funnel . . . . .	10 „
Length of funnel . . . . .	5 „
Aperture of funnel . . . . .	1·3 „
Diameter of external eyelid . . . . .	1 „
Length of dorsal arm . . . . .	14·25 „
„ dorso-lateral arm . . . . .	16 „
„ ventro-lateral „ . . . . .	22 „
„ ventral „ . . . . .	27 „
Maximum width of lateral membrane—	
On ventral arms . . . . .	1·2 „
On ventro-lateral arms . . . . .	1 „
On dorso-lateral arms . . . . .	·4 „
Length of pen . . . . .	40·4 „
Breadth „ . . . . .	·75 „

The colour of this specimen in spirit is of a dull purplish-brown, lighter and yellower on the lower surface, darker and inclining to heliotrope and blue on the upper surface of the mantle, head, and on the outer surface of the arms. The buccal membrane, inner surface of the arms and suckers are paler.

The mantle, as seen in the figure from the ventral surface, tapers gradually until the middle of the fin, where it is very narrow; it then enlarges slightly, and is produced beyond the fin at its apex (*ap.prol.*) very much as in *Cheiroteuthis Picteti*, a species

admirably described by M. Joubin (2). This apical prolongation of the mantle is shorter than in the latter species, and moreover is provided with a lateral fin on each side (*ap.f.*), a character which distinguishes the present species at once from any hitherto described. The mantle is laterally compressed, forming slight median longitudinal upper and lower ridges. Dorsally the mantle-edge is produced in a point above the neck; below it is raised opposite the funnel. The fins are wide, the outlines of the right and left together forming an almost perfect circle (*f*, fig. 51).

The funnel, provided with a large internal valve, is fixed to the head without distinct bridles, and at its posterior edge carries two sockets, each possessing two prominent lobes fitting into corresponding depressions in the mantle (fig. 56, *a* & *b*).

The head is small; the eyes moderately large and without sinus. About halfway between each eye and the attachment of the siphon is an olfactory papilla (*olf.p.*), about 2 mm. in length. The buccal membrane is well developed, with seven lobes and ridges. The mandibles are very sharp (fig. 54, *a* & *b*); the upper mandible has a basal tooth on either side (*bt.*, fig. 54*b*), corresponding to which are small teeth on the lower mandible. The radula consists of seven rows of teeth (fig. 57), closely resembling those of *C. Picteti*, Joubin (2).

All the arms are somewhat square in section, and are provided along the upper and outer edge with a membrane very narrow in the first two pairs, absent in the third, and very broad in the fourth (*m*). The third and fourth pairs have narrow membranes along the lower and outer edge\*.

Two rows of small suckers are placed rather far apart along each arm (rather more closely set on the dorsal than on the ventral arms). Each sucker is obliquely set on a slender stalk, and has a narrow opening, the horny ring of which is armed on the distal side with square teeth (fig. 55). The soft rim of the sucker is more or less raised up into a peak above the toothed horny margin (fig. 55). On the ventral arms, at the base of the outer row of suckers are convex pigmented patches, no doubt similar to the "vésicules réfringentes" described by Joubin in *Ch. Veranyi* (3).

The tentacular arms, which have unfortunately lost their clubs, are long and slender, bearing at intervals the modified flattened suckers characteristic of the genus.

The pen was somewhat injured owing to the contraction of the mantle. It is very long and narrow (fig. 52, *a* & *b*); the hollow cone reaches halfway up and opens by an oblique aperture. Diagrams of transverse sections of the cone and of the anterior region are given in figure 53, *a* & *b*. The pen thus closely resembles that of *Ch. lacertosa*, described by Verrill (9), and of *Ch. Picteti*; yet the portion in front of the cone is not tubular, as figured by Joubin for the latter species. *Ch. Veranyi*, on the other hand, has hitherto been described, by d'Orbigny and Férussac (5), and by Vérany (8), as possessing a pen flattened and expanded at both ends. On examining a specimen from the Mediterranean, I find, however, that its pen resembles in every essential that of *Ch. macrosoma* here figured; in the case of the works referred to, the artist probably flattened out the slender cone before drawing it.

\* These membranes correspond rather to the keels in other forms, as they do not spring directly from the sucker-bearing surface of the arm.

Of the four species\* of *Cheiroteuthis* hitherto known, two come from the Atlantic, one from the Mediterranean, and one from Amboyna. In general shape and size the present species approaches most nearly the latter, *Ch. Picteti*; yet it differs from it in the possession of a fin along the apical region of the mantle, in the beak, horny ring of the suckers, socket at the base of the siphon, and pen.

CHEIROTEUTHIS PELLUCIDA, n. sp. (Pl. 4. figs. 58, 59, 60, & 61.)

This small specimen, captured at a depth of 922 fathoms off the Vizagapatam coast, lat. 16° 11' 15" N., long. 82° 30' 30" E., was brought up alive on deck, when it appeared transparent, with dark purple chromatophores. In spirit it is still remarkably transparent, and the chromatophores (not represented in fig. 58) are very large and few in number, scattered at wide intervals over the body, fins, and arms.

The principal measurements are as follows:—

Length of the mantle (lower surface) . . . . .	4·8 centim.
Breadth           " . . . . .	·8   "
Length           "       to sudden constriction . . . . .	2·6   "
"       "       beyond fin . . . . .	·6   "
"       of fin-attachment . . . . .	2·1   "
Breadth of fin . . . . .	1·8   "
Length from mantle-edge to base of arms . . . . .	2·2   "
Breadth across eyes . . . . .	·7   "
Length of dorsal arm . . . . .	1·4   "
"       dorso-lateral arm . . . . .	1·8   "
"       ventro-lateral   " . . . . .	2·3   "
"       ventral           " . . . . .	4·5   "
"       tentacular       " . . . . .	8   "
"       "       club . . . . .	3   "

In general appearance this interesting little *Cheiroteuthis* reminds us strongly of *Dorotopsis vermicularis* (Rüppell) by its long and almost cylindrical mantle with a narrow apex, its long thick neck, and the great disparity in size between the ventral and remaining three pairs of arms.

The mantle, as already mentioned, is nearly cylindrical until it suddenly narrows down in the region of the fins to a narrow straight prolongation, which extends beyond the fins, forming a rounded spine (fig. 58). The fins themselves are broad and rounded (*f*), but the outline is less circular than in the preceding species. Dorsally the mantle projects over the neck in a small point.

The funnel is sharply recurved at its apex, and provided internally with a broad valve produced and thickened at the sides. The socket of attachment is shown in fig. 59.

The head is hardly wider than the neck; the eyes are somewhat prominent. Between these and the siphon are two olfactory papillæ (*olf.p.*). The buccal membrane is furnished with seven well-marked ridges and lobes.

Beyond the eyes the head narrows considerably, and enlarges again to support the

\* M. Joubin has lately described a new species from the Atlantic (4).

arms. The three small and dorsal pairs of arms bear two rows of suckers, and have no lateral membrane. The large ventral arms have a membrane on the upper side; toward the base they bear two rows of suckers, but about halfway up the suckers come to alternate in so nearly the same straight line that there appears here to be only one row. The horny ring of the suckers (fig. 60) is armed with rounded teeth on the proximal, and powerful sharp teeth on its distal side.

The tentacular arms are comparatively short, and provided at intervals with numerous flattened suckers. The long clubs bear four rows of small suckers, the outer row of which has the longest stalks. Round the margin of the club is a ribbed lateral membrane; the apex ends in thickened, deeply pigmented, and somewhat spoon-shaped knob. The horny ring of the suckers has a wide papillary area bearing sharp teeth, and characteristically notched on its distal border; the proximal margin of the ring is smooth, the distal margin armed with powerful sharp teeth (fig. 61).

I have not dissected out the pen; it appears to closely resemble that of the foregoing species.

Although, as the description shows, this specimen closely resembles *Doratopsis*, yet the structure of the tentacular arms shows that it undoubtedly belongs to the genus *Cheiroteuthis*.

HISTIOPSIS HOYLEI, n. sp. (Pl. 4. figs. 62, 63, 64, 65, 66, 67, 68, 69, 70, & 71.)

One specimen captured near the Andamans, at a depth of 490 fathoms.

Length of mantle to notch between fins (upper surface) . . . . .	2.2 centim.	
"          "          to apex (lower surface) . . . . .	1.9	"
Breadth          "          . . . . .	1.2	"
Length of fin-attachment to posterior notch . . . . .	.6	"
"          fin beyond mantle-apex . . . . .	.3	"
"          combined fins . . . . .	1.3	"
"          dorsal arm . . . . . (right)	3.5 centim.	(left) 3.3 centim.
"          dorso-lateral arm . . . . . "	3.4	" 3.7 "
"          ventro-lateral " . . . . . "	3.1	" 3.4 "
"          ventral          " . . . . . "	3	" 3.2 "
"          tentacular          " . . . . . "		" 7 "
"          pen . . . . .	2.1 centim.	
Breadth of " . . . . .	.6	"

The mantle swells out slightly midway, then tapers to a blunt point (figs. 62 & 66). Dorsally it projects above the neck; the lower margin is nearly straight. The fins are rounded, joined distally above the mantle-apex, beyond which they project.

The funnel is strongly recurved (*si.*, fig. 68); the two lips which bound its aperture are so applied to each other as to leave a narrow U-shaped opening. The sockets at the base of the funnel are I-shaped (*so.*); two small bridles bind it to the head. Inside we find a small valve prolonged into the upper portion of the 'funnel-organ,' which covers the upper or attached wall of the siphon, and into which fit two rounded flaps fixed on either side to the lower or free wall of the siphon. The whole arrangement closely

resembles that described and figured below in *Taonius abyssicola*. Mr. Hoyle makes no mention of the 'funnel-organ' in his species (1).

The head is wide and sharply marked off from the narrow neck. Below each eye is an olfactory papilla (*olf.p.*, fig. 64).

The eyes are large, with widely open eyelids (figs. 62 & 64); the left eye is injured and protrudes from the eyelid, it has been restored in the figure.

The arms, which differ somewhat in length on the right and left sides, appear to be in the following order of length: 2, 1, 3, 4. Unlike *H. atlantica* of Hoyle, the web at the base of the arm is quite rudimentary (fig. 63). The small suckers, placed in two rows on all the arms, are of a peculiar conical shape (figs. 69 & 70), with a wide opening furnished with a narrow horny ring armed round its margin with small sharp teeth.

The left and only complete tentacle enlarges at its extremity into a small club (figs. 62 & 65), bearing four regular rows of small suckers on its distal half, and as many as six irregular rows on its proximal half. At the widest region of the club the central suckers attain a large size (fig. 65). They have round shallow cups, set almost straight on short thick stalks (fig. 67); the margin of the horny ring is armed with numerous long straight pointed teeth. Near the base there is a connective apparatus consisting of a row of three alternating suckers and tubercles (*c.app.*, fig. 65); two or three small suckers are scattered down the stem.

The buccal membrane has seven lobes, with corresponding ridges extending on to the arms, as shown in figure 63.

The delicate little pen is lanceolate (fig. 71).

The colour of this specimen in spirit is pale yellowish-brown, covered with dark purplish-brown chromatophores, on the mantle, upper surface of the fins, head, buccal membrane, and arms (especially on their inner surface).

As seen in the figure, a large number of U-shaped pigmented organs, most probably phosphorescent (see Joubin, 3 & 4 a), are scattered in irregular transverse rows on the lower surface of the mantle, head, and arms; a few extend over to the upper surface, and one row surrounds each eye (fig. 64). The first three pairs of arms have one row each extending to their tips, whilst the larger ventral arms have three rows proximally, reduced to two distally.

The exact systematic position of this little Cephalopod is not very easy to determine. I have placed it provisionally in the genus *Histiopsis* of Hoyle, from whose specimen it differs in the absence of a distinct web at the base of the arms, in the horny rings of the suckers, in the buccal membrane, in the continuation of the fins beyond the mantle-apex, in the possession of one row only of pigmented organs on the first three pairs arms, and perhaps in the presence of the 'funnel-organ' (Verrill's organ).

The horny rings of the tentacular suckers are very like those of *Histioteuthis*, to which genus it is no doubt closely related.

#### CALLITEUTHIS REVERSA, Verrill.

One specimen of this widely distributed species was caught in the Andaman Sea at a depth of 265 fathoms.



TAONIUS ABYSSICOLA, n. sp. (Pl. 5. figs. 72, 73, 74, 75, 76, 77, 78, 79, & 80.)

Two specimens from the Laccadive Sea belong to this genus. The first, the large specimen shown in figure 72, comes from a depth of 902 fathoms. It is somewhat injured; the skin has been rubbed off the mantle, fins, and head, and the eyes have burst out of their lids. The second specimen, from a depth of 1370 fathoms, is very much smaller and in a less satisfactory state of preservation.

The principal measurements of the large specimen are as follows:—

Length of mantle (lower surface) . . . . .	7·6 centim.
Breadth „ near edge . . . . .	3·8 „
Length of fin-attachment . . . . .	2·4 „
Breadth across combined fins . . . . .	1·7 „
„ of head between eyes . . . . .	·7 „
„ across eyes . . . . .	2·8 „
Length of dorsal arm . . . . .	2·5 „
„ dorso-lateral arm . . . . .	2·8 „
„ ventro-lateral „ . . . . .	3·3 „
„ ventral „ . . . . .	2·8 „
„ tentacular „ . . . . .	4·2 „
„ „ club . . . . .	1·1 „

The mantle is loose, enclosing an ample cavity; it diminishes gradually to the origin of the fin, and then suddenly to the narrow apex. The outline of the fins is egg-shaped. The mantle is attached by a lozenge-shaped cartilaginous plate to the back of the neck, and on both sides to the base of the siphon.

The aperture of the funnel is covered by the sharply recurved upper lip (fig. 72). All previous observers have described the funnel of this species as destitute of valve.\* On slitting up the funnel of this specimen and turning aside the two sides as shown in figure 74, I found that the inner and upper wall is sharply bent inwards near the opening so as to form a deep pit where the siphon is fused to the head. On either side of this pit are the two cushions (*c*) noticed by Verrill (9), which in their normal position almost close up the lumen of the funnel. When these two cushions are pushed aside, a *well-developed valve* is disclosed rising from the bottom of the pit (fig. 74, *v.*). Behind the cushions, further down the funnel, are two triangular flaps, flattened and fastened by their base to the sides of the funnel (*t.fl.*, fig. 74); they appear to be of a glandular nature, and probably correspond to the lateral pads described in other forms by Weiss (10).

On the inner and upper wall of the siphon is a wide  $\Lambda$ -shaped plate—the funnel-organ—very similar in shape to that figured by Weiss in *Verania sicula*. In the present instance it was so loosely attached that it readily came off; it is represented in figure 75, and its position is indicated by a dotted line in figure 74. On the inner surface this plate is produced on either side into a triangular cap (*t.c.*), which fits closely as a glove

\* Since this was written M. Joubin (4) has described a small valve in the siphon of a new species of *Taonius* from the Atlantic.

on to the flaps already described lying opposite them.\* I have confirmed these observations on the second specimen.

Contrary to Verrill's observations in two other species (9), I find on either side between the eye and the funnel a truncated olfactory papilla (fig. 76). It is slightly expanded and flattened distally, the flat oblique surface being concave.

The head appears to have been narrow. The two eyes are very large and protrude from their sockets.

The arms are thick, and of considerable length for this genus. The three dorsal pairs are provided on both sides with a well-developed lateral membrane (largest in the third pair), springing from the inner edge and supported by muscular thickenings arising from the base of each sucker (fig. 73). The ventral arms are also provided with such a membrane on the lower edge; but it is rudimentary on the upper side, where on the contrary the outer edge of the arm is produced into a lateral keel. On all the arms we find two rows of suckers, largest on the third pair. The suckers (figs. 77, 78), very obliquely set on a short stalk, have a wide opening provided with a horny ring, armed on the distal margin only with about 14 squarish teeth. The papillary area is narrow.

The tentacular arms are thick-stemmed, the clubs only slightly enlarged and bearing a lateral membrane on either side similar to that of the arms. The suckers of the club are compressed and considerably injured in this specimen; they appear to be set in four rows, and of a peculiar conical shape (fig. 80). The stalk of the sucker swells gradually to the base of the cup, where there is a thickened ridge; it then narrows and expands again into a bell-shaped cup, with an oblique opening. The margin of the horny ring is armed with eight or nine strong curved teeth, extending round the distal two-thirds of the circumference. The striated outer margin is frayed out into a fringe, but this is probably artificial. From the club extending down the stem are small short-stalked round suckers, the horny margin of which is armed all round with blunt teeth (fig. 79). Distally at the base of the club these suckers are placed in four rows, which dwindle gradually to two rows proximally, where the suckers are very small and set in pairs on either side of a median groove.

The buccal membrane has seven ridges; the lobes are indistinctly marked.

Purplish-brown chromatophores colour the fragments of skin adhering to the head and arms, the lateral membranes between the ridges, and the buccal membrane.

The pen can be seen, without dissection, as a narrow ridge starting from the nuchal plate and expanding posteriorly into a thin plate, narrowing again to form a slender cone, as figured by Pfeffer for *Taonius (Megalocranchia) maximus* (6).

The second specimen is very much smaller, and is possibly a young individual of the same species; it is, however, not in a sufficiently good state of preservation to allow one to make certain of its specific identity.

\* In their normal position the points of the flaps are directed away from the middle line; in figure 74 they are directed inwards owing to the stretching open of the funnel.

## OCTOPODA.

## Family PTEROTI.

## CIRRHOTEUTHIS PACIFICA, Hoyle?

A small and mutilated specimen, captured at a depth of 265 fathoms in the Andaman Sea, has been referred to this species.

## Family OCTOPODIDÆ.\*

## OCTOPUS VULGARIS, Lam.

One large female from the Andamans, and one smaller male from Point Galle, Ceylon. These specimens resemble very closely our common Octopod, and I could find no important distinction between the European and Indian forms.

## OCTOPUS GRANULATUS, Lam.

Eleven specimens have been placed in this species. Three come from Port Blair, three from the Andamans, one from Great Cocos Island, one from Bombay, two from the Southern portion of the Malacca Straits, and one from Maskat in Arabia.

## OCTOPUS GLOBOSUS, Appellöf. (Pl. 5. fig. 81.)

One specimen from the Nicobars, one from the Kabusa Islands (Mergui Archip.), five from the Southern portion of the Malacca Straits, three from Bombay, and one from Point Galle, Ceylon—in all eleven specimens have been referred to this species. The extremity of the hectocotylized arm of a male is shown in figure 81.

OCTOPUS PICTUS (Brock), var. *fasciata*, Hoyle. (Pl. 5. fig. 82.)

One male specimen from Port Jackson, which agrees very closely with the specimen described by Hoyle in the 'Challenger' Report. The extremity of the hectocotylized arm, however, shown in fig. 82, differs considerably from that described by Hoyle in *Oct. maculosus* (Proc. R. Phys. Soc. Edinb. vol. viii. 1883), which he considers to be the same species. It seems probable that the var. *fasciata* may have to be separated as a distinct species.

## OCTOPUS JANUARI, Stp.

Three specimens appear to belong to this widely distributed and abyssal species. One, a female, comes from a depth of 193 fathoms in the Bay of Bengal (lat. 20° 17' 30" N., long. 88° 30' E.); the other two are males captured at a depth of 271 fathoms in the Andaman Sea.

The ridges on the hectocotylized tip of the arm in the male are more marked than in the figure given by Hoyle in the 'Challenger' Report (1), but in all essential respects these specimens agree with his description.

\* I must express my thanks to Mr. W. E. Hoyle for kindly examining some of these Octopods.

## OCTOPUS MACROPUS, Risso.

With considerable doubt eight specimens have been referred to this species. Seven come from the Andaman Islands (three from Port Blair) and one from the Malacca Straits.

## OCTOPUS ACULEATUS, d'Orb.

Ten specimens from the Andaman Islands (six from Port Blair), one from Colombo, and one from Little Cocos Island. It is with some doubt that these have been placed in this species, which is not very thoroughly defined.

## OCTOPUS LEVIS, Hoyle?

One female specimen from Gopalpur, at a depth of 7 fathoms, has been provisionally placed in this species. It agrees closely, although not perfectly, with Hoyle's description.

## OCTOPUS MICROPHTHALMUS, n. sp. (Pl. 5. figs. 83, 84.)

One female specimen from Port Blair, Andaman Islands (fig. 83).

This species is remarkable from the smooth cylindrical shape of the head and mantle, the eyes forming no prominence whatever on the surface of the head. The mantle ends obtusely, and fits closely on to the head; the mantle-opening, which is very narrow, reaches rather more than halfway from the siphon to the eye. The aperture of the eyelid is small. The funnel reaches to within 4 mm. of the edge of the web between the ventral arms; it is attached to the lower surface of the head along almost its entire length. The arms are rounded, and bear small somewhat conical suckers, which are arranged some distance apart. Although they are placed in two rows, the suckers are situated in zigzag fashion so as to approximate to the condition found in *Eledone*, for instance, where they are in one row. The mandibles are dark and strong (fig. 84, *a* & *b*).

The following are the principal measurements:—

Length of mantle and head to lower edge of web between ventral arms . . .	4.5 centim.
„ „ to mantle-edge . . . . .	2.7 „
Breadth of mantle . . . . .	2 „
„ head across eyes . . . . .	1.5 „
Length of dorsal arm . . . . .	8.6 „
„ dorso-lateral arm . . . . .	8.1 „
„ ventro-lateral „ . . . . .	6.9 „
„ ventral „ . . . . .	6.9 „

There is a small web at the base of the arms, reaching 1.6 cm. from the mouth between the dorsal arms, where it is longest (the inner surface of this web is the same between the bases of all the arms).

The colour is yellowish-brown, inclining to dark brown on the upper surface of the mantle, head, and outer surface of the arms.

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<i>a.</i> Arm.	<i>loc.</i> Striated region of loculi.
<i>ap.f.</i> Apical fin.	<i>l.olf.f.</i> Left olfactory fold.
<i>ap.prol.</i> Apical prolongation of the mantle.	<i>m.</i> Membrane.
<i>ap.s.</i> Apical set of suckers.	<i>mo.</i> Mouth.
<i>b.m.</i> Buccal membrane.	<i>m.s.</i> Modified sucker.
<i>b.t.</i> Basal tooth.	<i>mt.</i> Mantle.
<i>c.app.</i> Connective apparatus.	<i>olf.p.</i> Olfactory papilla.
<i>ch.m.</i> Chitinous margin.	<i>ph.org.</i> Phosphorescent organ.
<i>d.a.</i> Dorsal arm.	<i>pp.</i> Pigmented patch.
<i>e.</i> Eye.	<i>r.s.</i> Rudimentary sucker.
<i>e.l.</i> Eyelid.	<i>s.</i> Sucker.
<i>f.</i> Fin.	<i>si.</i> Siphon.
<i>f.l.</i> Lateral membrane developed into a flap.	<i>so.</i> Socket.
<i>h.</i> Hook.	<i>t.</i> Tentacular arm.
<i>hd.</i> Head.	<i>t.c.</i> Triangular cap.
<i>i.c.</i> Inner cone.	<i>t.fl.</i> Triangular flap.
<i>i.l.m.</i> Inner lateral membrane.	<i>v.</i> Valves.
<i>k.</i> Keel.	<i>v.a.</i> Ventral (4th) arm.
<i>l.m.</i> Lateral membrane.	<i>v.h.a.</i> Ventral hectocotylized arm.

## EXPLANATION OF THE PLATES.

## PLATE 1.

*Iniotenthis maculosa*, n. sp.

- Fig. 1. View of lower surface, nat. size.  
 2. Enlarged view of the horny ring of a tentacular sucker.  
 3. Enlarged side view of a tentacular sucker.

*Sepia singalensis*, n. sp.

- Fig. 4. Outline of the mantle and fins, and figure of the pen (inner surface), nat. size.  
 5. Enlarged view of a spermatophore.  
 6. Upper (*b*) and lower (*a*) mandibles, nat. size.  
 7. Enlarged view of a portion of the horny ring of a small tentacular sucker.  
 8. Horny ring of a small sucker of an arm.

*Sepioteuthis indica*, n. sp.

- Fig. 9. Outline of the mantle and fins, reduced.  
 10. Figure of the pen of another specimen, reduced.  
 11. Enlarged view of a portion of the horny ring of an apical sucker of the tentacular club.  
 12. Enlarged view of the apex of the tentacular club.  
 13. Side view of the head, showing the olfactory fold, nat. size.  
 14. Upper (*b*) and lower (*a*) mandibles, nat. size.  
 15. Horny ring of a sucker of the buccal membrane, enlarged.  
 16. Portion of the left 4th arm of a male, enlarged.  
 17. Edge of the horny ring of a sucker of the 3rd arm, enlarged.  
 18. Large tentacular sucker,  $\times 4$  diam.  
 19. Portion of the edge of the horny ring of tentacular sucker, enlarged.

## PLATE 2.

*Loligo indica*, Pfeffer.

- Fig. 20. Edge of the horny ring of an arm-sucker of a male, enlarged.  
 21. Horny ring of a sucker of the buccal membrane, enlarged.  
 22. Lower view of the left 4th arm of a male, showing the hectocotylization, nat. size.  
 23. Portion of the hectocotylized region of the same, inner view enlarged.  
 24. Horny ring of a small tentacular sucker, enlarged.  
 25. Enlarged view of a portion of the horny ring of an apical sucker of the tentacular club.  
 26. Horny edge of an arm-sucker of a female, enlarged.  
 27. Enlarged view of a portion of a large tentacular sucker of the same.  
 28. Enlarged view of a spermatophore.

*Loliolus Investigatoris*, n. sp.

- Fig. 29. Upper view of a male, nat. size.  
 30. Outline lower view of the mantle and fins, nat. size.  
 31. Upper view of the pen, nat. size.  
 32. Lower view of the hectocotylized 4th left arm, nat. size.  
 33. Enlarged inner view of a portion of the same.  
 34. Enlarged views of the upper (*b*) and lower (*a*) mandibles.  
 35. Horny ring of a tentacular sucker, enlarged.  
 36. Side-view of an arm-sucker, enlarged.  
 37. Edge of the horny ring of the same, enlarged.

*Abralia andamanica*, n. sp.

- Fig. 38. Lower view, nat. size.  
 39. Outline upper view of mantle and fins, nat. size.  
 40. Enlarged view of the tentacular club.  
 41. Upper (*a*) and side (*b*) views of the pen of a smaller specimen, nat. size.  
 42 & 43. Front and side views of an arm-sucker, enlarged.  
 44 & 45. Front and side views of a tentacular sucker, enlarged.

## PLATE 3.

*Abralia lineata*, n. sp.

- Fig. 46. Upper view, nat. size.  
 47. Lower view, enlarged.  
 48. Enlarged view of the tentacular club.  
 49. Horny ring of an arm-sucker, enlarged.  
 50. Horny ring of a tentacular sucker, enlarged.

*Cheiroteuthis macrosoma*, n. sp.

- Fig. 51. Lower view, nat. size.  
 52. Upper (*a*) and side (*b*) views of pen, nat. size.  
 53. Diagram of a section of pen across anterior region (*b*) and cone (*a*), enlarged.  
 54. Upper (*b*) and lower (*a*) mandibles, nat. size.  
 55. Sucker of the ventral arm, enlarged.  
 56. Socket (*a*) at the base of the siphon, and cushion on the mantle (*b*), nat. size.  
 57. Teeth of the radula, enlarged.

## PLATE 4.

*Cheiroteuthis pellucida*, n. sp.

- Fig. 58. Lower view, nat. size.  
 59. Socket at the base of the siphon, enlarged.  
 60. Sucker of the arm, enlarged.  
 61. Tentacular sucker, enlarged.

*Histiopsis Hoylei*, n. sp.

- Fig. 62. Lower view, nat. size.  
 63. Enlarged view of the mouth, buccal membrane, and the base of the arms.  
 64. Enlarged view of the right side of the head.  
 65. Enlarged view of the tentacular elub.  
 66. Upper view in outline of the mantle and fins, nat. size.  
 67. Enlarged side view of a large tentacular sucker.  
 68. Enlarged left-side view of the funnel and mantle-edge.  
 69 & 70. Enlarged side and front views of an arm-sucker.  
 71. Upper view of the pen, nat. size.

## PLATE 5.

*Taonius abyssicola*, n. sp.

- Fig. 72. Lower view, nat. size.  
 73. Inner view of a portion of the dorsal arm, enlarged.  
 74. Enlarged view of the base of the head and siphon and mantle slit up along the median line and turned aside.  
 75. Funnel-organ, lower view, removed from its place on the wall of the siphon, indicated by a dotted line in fig. 74, enlarged.  
 76. Enlarged view of the olfactory papilla.  
 77. Side view of an arm-sucker, enlarged.  
 78. Horny ring of the same, enlarged.  
 79. Enlarged view of a portion of the horny ring of a small sucker at the base of the tentacular club.  
 80. Front (*a*) and side (*b*) views of a tentacular sucker.

*Octopus globosus*, Appellöf.

- Fig. 81. Enlarged view of the extremity of the hectocotylized arm.

*Octopus pictus* (Brock), var. *fasciatus*, Hoyle.

- Fig. 82. Enlarged view of the extremity of the hectocotylized arm.

*Octopus microphthalmus*, n. sp.

- Fig. 83. Lower view, nat. size.  
 84. Lower (*a*) and upper (*b*) mandibles, enlarged.